REMARKS

By the foregoing amendment, claim 21 has been made the primary claim in this case by being incorporated into claim 1 with rewording for increased clarity but without changing the scope of prior claim 21. The claims now positively recite that the product is a solid but the process as claimed previously does, as shown in the working examples, result in solid spherical particles when radiant heat is employed and a Declaration attesting to those examples is already of record.

Claims 1, 3-13 and 21 were rejected as being obvious over Kodas alone or in combination with Rosencwaig, under 35 U.S.C. § 103. It is respectfully submitted that these rejections should be withdrawn.

The broadest claim under consideration relates to a method of manufacturing a solid glass powder having a desired average particle size. It involves spray-thermally decomposing, using radiant heat, a mixed solution which contains (1) a glass network-forming element raw material oxide powder having an average particle size which does not exceed about 1/5 of the average particle size of the desired glass powder and (2) an aqueous solution of a water soluble compound of a different glass-forming element. The radiant heat spray thermal decomposition is effected at a thermal decomposition temperature which is selected depending on (a) the relative amount of the raw material oxide powder based on the total of the powder and the water soluble compound and (b) the average particle size of the powder. When the relative amount of the oxide powder is less than 45% by weight, then the decomposition temperature is above the melting point of the glass by either about 20°C or 50°C depending on whether the raw material oxide powder average particle size is less or more than 1/25th of the average particle size of the powder. When the amount of the raw material oxide powder is

more than about 45% by weight, then the spray thermal decomposition temperature is at least the melting point of the glass powder or the melting point plus 30°C depending on whether the powder is less or more than 1/25th of the average particle size of the glass powder. The claimed process is not obvious over Kodas, whether considered alone or in combination with Rosencwaig.

The Kodas patent relates to a method of producing a glass powder by spray pyrolysis. In a description which extends over 38 columns, the process involves generating an aerosol and then subjecting the aerosol to spray pyrolysis in a furnace. A feed of a liquid containing flowable medium containing at least one precursor of the glass is converted to aerosol form with droplets of the medium being dispersed in and suspended by a carrier gas. While the reference indicates that product may be either solid or hollow, it does not indicate the steps necessary to achieve a solid product. This is particularly relevant since the prior art teaches that processes employing radiant heat produce hollow glass particles. Thus, one skilled in the art would not employ radiant heat if that person was trying to use the Kodas teachings to achieve a solid sphere. The applicants found that when employing radiant heat, solid spherical glass particles could be realized if the parameters recited in the claims are observed. This is surprising and unexpected.

Kodas does, solely because of its extreme breath, have disclosure which in some, but not all, respects, encompasses parameters recited in the instant claims. Individual selection of the appropriate parameters, however, requires the use of hindsight, and combination of such parameters is not suggested. Moreover, other parameters recited in the instant claims are not referenced in Kodas at all.

The Kodas flowable liquid can contain only liquid constituents or can contain suspended particles, such as colloidal silica particles (col. 5, lines 30-33). Nothing in Kodas teaches or suggests to one skilled in the art to make the raw material powder

particle size 1/5 of the average particle size of the resulting glass powder, or less, as opposed to a different value. To the contrary, Kodas teaches that the size which is significant is that relative to the size of the droplets in the aerosol (col. 5, lines 36-39). The size relative to the size of the final product is not even mentioned. While the Examiner has done a calculation based on the fact that the particulate can be typically about 1 μm to about 0.1 μm in size, and the final glass particles can range in size from about 0.05 μm to 20 μm, nothing in the reference suggests this ratio has any significance whatsoever and therefore, the Examiner is relying on hindsight by even doing the calculation. Moreover, the calculation means that the particle size ratio of particulate to glass can theoretically range from the 20:1 to 1/0.005. There is obviously an extremely large number of ratios that can be realized within this range but there is nothing in Kodas which suggests one skilled in the art to make the raw material powder particle size 1/5 of the average particle size of the resulting glass powder, or less, as opposed to a different value, and particularly when radiant heat is being employed.

The instant claims recite that the spray-thermal decomposition temperature is selected based on the amount of the solid raw material oxide in the mixed solution and more particularly, whether that amount is more of less than 45% by weight. Claims 8, 9, 12 and 13 relate to the method when the amount of solid in the feed, the mixed solution, is more than 45%. Kodas teaches in those instances in which the liquid feed includes suspended particles, those particles preferably comprise "not greater than about 15 weight percent of the liquid feed." (Column 5, lines 49-51). Nothing in the reference teaches or suggests a situation in which the solid is at least 3 times the maximum preferred by Kodas and the Examiner has not explained why one skilled in the art would be motivated to ignore this explicit teaching in the reference. While the Office Action does make reference to Tables I and II as showing concentrations of 8-26 or 54-55 percent by weight of silica, the Office Action incorrectly identifies this silica

raw material oxide as being a "powder". The Tables indicates the percentage of silicon dioxide in the glass but nowhere does the reference teach or suggest that the silicon dioxide percentages set forth in these Tables refers to a solid component. The only indication in this reference which refers to the amount of the solid component in the feed is the passage in column 5 and that states that the maximum is 15%.

The statement on page 3 of the Office Action that since the client's powder is formed from drops of the Kodas mixed solution, it would be obvious to a skilled person that the Kodas solution has a silica concentration either less than or greater than 45% by weight is technically accurate but as a practical matter, it is also inaccurate and misleading since it is ignores the frame of reference. The silica concentrations in Tables I and II refers to the concentration in the glass produced as a whole whereas the 45% by weight in the instant claims relate to the concentration of solid in the feed.

The instant claims recite that radiant heat is used. Kodas does teach radiant heat can be used but also indicates in column 8 that use of a metallic tube furnace can result in limited operating temperatures and increased reactivity in some systems leading to, for example, discoloration of the glass particles produced. Kodas thus teaches other types of reactors can be used such as a flame reactor or plasma reactor.

There is nothing in Kodas which teaches or suggests to one of ordinary skill in the art that when radiant heat is employed and the raw material powder particle size is 1/5 or less of the average particle size of the resulting solid glass powder, the pyrolysis temperature should be selected depending on the relative amount of the raw material oxide powder based on the total of the powder and the amount of the water soluble compound in the aqueous solution (calculated as oxide). Thus, in those instances where the Kodas procedure by serendipity would include use of radiant heat and a raw material powder particle size of 1/5 or less of the average particle size of the

solid glass product powder, the reference is still deficient in not suggesting the temperature is dependent on the solid content of the feed.

Kodas does teach that the pyrolysis temperature can range from 300° to 1500°C. However, nothing in the reference teaches or suggests that the temperature within this range be selected be based on whether or not the raw material powder is less than or greater than 45% of the combination with the water soluble compound and whether or not the raw material oxide powder has an average particle size of more or less than 1/25th of the average particle size of the solid spherical glass powder being produced. Kodas does teach that the formation of hollow particles can be controlled through the selection of precursors, precursor concentrations, pyrolysis temperature and residence time in column 31. It may be fair to argue that the reference teaches that the formation of solid particles is also a function of these parameters but even so, there is no teaching or suggestion that the formation of solid particles is a function of the solid content in the feed and the average particle size of that feed relative to the desired product. When Kodas refers "precursor concentration", the reference is referring to the amount of glass forming components as a whole and not the distribution of those components between solid and liquid form.

The Office Action asserts that Kodas teaches that the raw material oxide powder's size depends on the particular application of the glass powder, citing column 30, lines 39-40. That passage, however, refers to the particle size of the final glass product and not to the particle size of the solid precursor in the liquid feed. There is no teaching or suggestion that the particle size of the solid in the feed bears any relationship to the temperature employed and, therefore, there is no recognition of this reference that the size (or amount) of the raw material oxide present in powder form is a result effective variable.

Finally, the Office Action asserts that the claimed steps of identifying the melting point of the glass and the amount of the solid raw material oxide and water soluble compound "are necessary and obvious steps made in order to provide the proper decomposition temperature that would melt the raw material and water soluble material." This assertion, however, lacks a factual basis. In any event, there is no basis in Kodas or elsewhere in this record which suggests that the distribution of the raw material oxide between solid and liquid forms has any relationship to the spray-thermal decomposition temperature employed nor that the average particle size of the solid relative to the particle size of the product has any relationship to the spray-thermal decomposition temperature employed.

Rosencwaig reference has apparently been cited to show that the temperature in a multi-stage oven varies by stages. Such a teaching does not cure the basic deficiencies in Kodas.

As shown in the working examples, the process claimed results in solid spherical particles when radiant heat is employed and a Declaration attesting to those examples is already of record. This result is surprising and unexpected. Nothing in the references teaches or suggests that the combination of parameters should be selected as set forth in the claims so as to realize this result. At best, it teaches various values of a few, but not all, of these parameters are within the realm of possibility in the context of broadly making a glass powder by spray pyrolysis. The art is at best an invitation to experiment and does not render the claimed invention obvious.

In light of all of the foregoing, it is respectfully submitted that this application is now in condition to be allowed and the early issuance of a Notice of Allowance respectfully solicited.

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Respectfully submitted,

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